City of Encinitas

Level 3 Assessment of Blue Gum Tree
Near 1717 N Vulcan Ave
Asset I.D. # 8281ETREE

SUBMITTED TO:

John Ugrob
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City of Encinitas

PREPARED BY:

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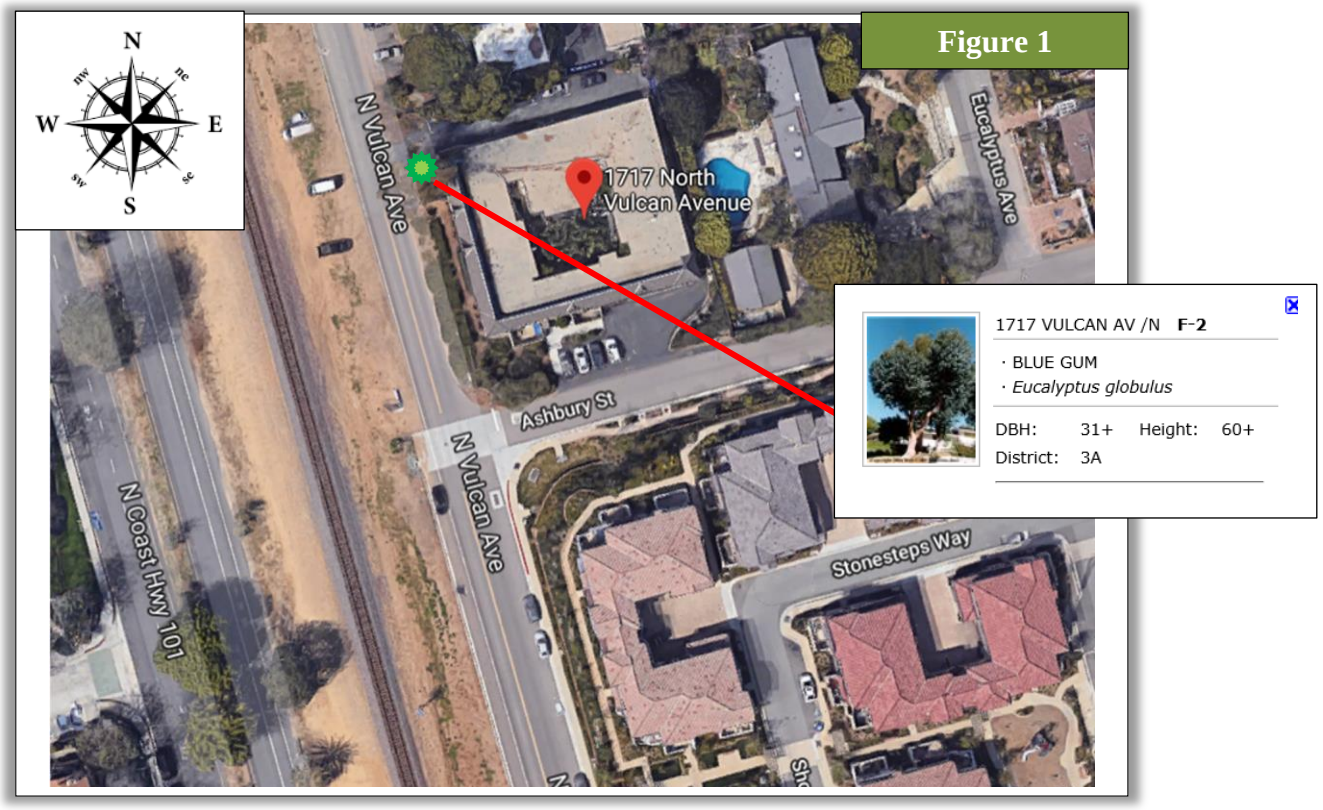
BACKGROUND AND ASSIGNMENT

In June of 2019, West Coast Arborists, Inc., (WCA) was contacted by the City of Encinitas in regard to the assessment of a Blue Gum (*Eucalyptus globulus*) tree located in front of 1009 2nd Street. In ArborAccess (WCA's tree inventory database), the tree is inventoried as 1009 02ND ST F-1 (see Figure 1 below).



The City had concerns regarding the tree and requested that WCA perform a **Level 3 Advanced Assessment**[1] to collect further information regarding its structure, health, and the associated risks it could be presenting. Assessments performed as part of this report are valid for a period of two years from the date of inspection and are based on the conditions present at the time of inspection. This time frame should not be considered a guarantee period for the risk assessment. The contents of this report are intended to be used by Mr. Ugrob and the City of Encinitas.

[1] Terms appearing in boldface type are defined in the Glossary at the end of this report.

OBSERVATIONS

I inspected the subject tree on June 5 of 2019. On site, I performed a Level 3 Advanced Assessment with the use of **sonic tomography** to assess potential trunk decays (see Appendix B for details)**.** I assessed the health and structural integrity of the tree using the **Best Management Practices (BMPs)** for tree risk assessment. I visually inspected the **crown** and **stem** of the tree, looking for structural defects such as **included bark**, **cavities**, **fungal fruiting bodies**, and/or **decay**. My inspection of defects in the crown was limited to a ground-level visual inspection. On site, I observed the following:

(Refer to photos in Appendix A)

- The tree was located on the east side of N Vulcan Avenue in front of the 1717 building. There were branches growing above the road as well as over several parking spots and the 1717 building.
- The tree had a DSH[2] measurement of 36 inches and a height of about 85 feet.
- The trunk of the tree was about 3 feet east of N Vulcan Avenue. There was pavement closely surrounding most of the tree's basal region.
- Judging by the color and density of the foliage, the tree was in poor health for the species and time of year. There was an abundance of branch dieback/ dead wood in the canopy.
- There was an abundance of stressed epicormic growth on the tree's bottom half. Twigs had galls from wasps and the leaves had marginal necrosis (tissue death) and tortoise beetle feeding damage.
- The tree had remanence of what appeared to be sulfur conks (*Laetiporus spp*.) at the base of the tree's west side.
- There main defects observed within the canopy were dead wood.

[2] Diameter at Standard Height (DSH) is the trunk diameter measured 4.5 feet above grade level.

RISK ASSESSMENT

Risk Assessment Methodology

Data collected from tree inspection is used to derive a level of risk based on the matrices found in the ISA Best Management Practices (BMPs) for tree risk assessment (see Appendix C – Tree Risk Matrices). The level of risk determined (*low, moderate, high, or extreme*) is to be used by risk managers to help in tree management decisions. When assessing risk, the value of targets is taken into consideration in order to categorize the *consequences of failure* (*negligible, minor, significant, or severe*). The people who use and frequent the target zone are generally the most important target with buildings, structures, and cars being secondary in importance.

Limitations of Tree Risk Assessment

According to the *Tree Risk Assessment Manual,* published by the International Society of Arboriculture (ISA), it is impossible to maintain trees free of risk: "There is no way to guarantee that a tree will not fail. Tree benefits increase as the age and size of trees increase; however, some level of risk must be accepted to experience the benefits provided. The goal in assessing and managing trees is to strike a balance between the risk that a tree poses and the benefits that individuals and communities derive from trees."

"A considerable level of uncertainty is typically associated with tree risk assessment due to our limited ability to predict natural processes (rate of progression of decay, response growth, etc.), weather events, traffic and occupancy rates, and potential consequences of failure."

"Conditions affecting trees change constantly; none of us will ever be able to predict every tree failure. Conducting a tree risk assessment neither ensures nor requires perfection. Risk assessment should, however, ensure that all reasonable efforts have been made to identify the *likelihood of failure*, the *likelihood of impact*, and the *consequences of failure* present at the time of assessment."

"Abnormally extreme storms, such as tornadoes, hurricanes, and heavy freezing rain, are not predictable and, in most cases, are not considered for categorizing *likelihood of failure.*"

Risk Assessment of Subject Blue Gum Tree

Likelihood of Failure[4]

After completing the advanced trunk assessment, the defect of greatest concern was the indication of basal decay (see Appendix B) that likely extended further down into structurally important roots. This decay can significantly compromise the strength and elasticity of the wood which can lead to unpredictable failures. The *likelihood of failure* because of basal/ root decay was assessed as **probable** within the next 2 years if no mitigation is taken.

Likelihood of Impacting Target

Based on short-term observations of occupancy rates and protection factors, the likelihood of this possible basal/ root failure causing the tree to impact a target was assessed as *low* for a pedestrian and moving vehicle, *medium* for a parked vehicle, the building, and Vulcan Ave itself.

Consequences

The consequences should a failure and target impact scenario occur were assessed as likely being *significant* for a Vulcan Ave itself, and *severe* for a pedestrian, a vehicle, and the adjacent building.

Based on the categorization of the above risk factors, the Blue Gum tree under discussion is currently presenting an overall *moderate* risk. **Refer to Appendix C for an example of going through the risk assessment matrices for a specified failure and target(s).**

DISCUSSION AND RECOMMENDATIONS

WCA recommends removing the tree because of the moderate risk it is presenting, its declining health/ lack of vigor, and the signs of significant basal/ root decay associated with an incurable fungal pathogen. This decision would completely eliminate the associated risks and make space for a new tree(s) to help maintain a healthy and diverse urban forest.

If preservation is essential, we recommend performing a canopy height reduction of approximately 30 feet, removing dead and diseased wood. This crown reduction will decrease the mechanical forces applied on the tree's defects of concern and should reduce the risk level to an overall low. Because of the tree's maturity and structure, a pruning dose of this magnitude may negatively impact the tree's already declining health as well as its visual character. Providing supplemental irrigation and treating for foliar pests may help reduce these stresses. In addition, the tree should be frequently and meticulously pruned to manage vigorous new growth and restore it to an acceptable structure. For the remaining life of the tree, I would recommend maintaining the newly reduced canopy size, and to have the tree periodically monitored for hazards and progression of decay.

APPENDIX A – PHOTOS

Photo #1

- The tree (red arrow) was located on the east side of N Vulcan Avenue in front of the 1717 building. There were branches growing above the road as well as over several parking spots and the 1717 building.
- The tree had a DSH[1] measurement of 36 inches and a height of about 85 feet.
- Judging by the color and density of the foliage, the tree was in poor health for the species and time of year. There was an abundance of branch dieback/ dead wood in the canopy.

APPENDIX A – PHOTOS

Photo #2

- The trunk of the tree was about 3 feet east of N Vulcan Avenue. There was pavement closely surrounding most of the tree's basal region.

APPENDIX A – PHOTOS

Photo #3

- The tree had remanence of what appeared to be sulfur conks (*Laetiporus spp*.) at the base of the tree's west side (red arrow).

APPENDIX A – PHOTOS

Photo #4

- There was an abundance of stressed epicormic growth on the tree's bottom half. Twigs had galls from wasps, and the leaves had marginal necrosis (tissue death) as well as tortoise beetle feeding damage.

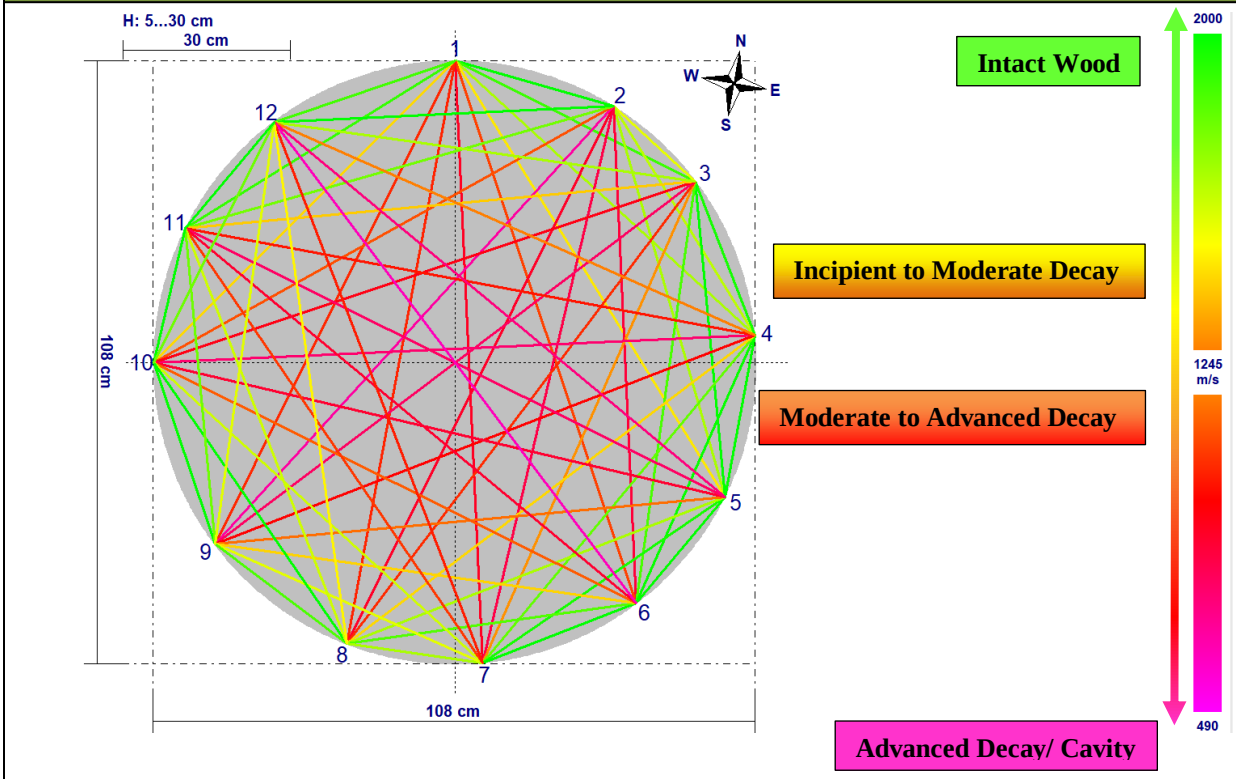
APPENDIX B – ADVANCED TRUNK ANALYSIS

Sonic Wave Tomography (Arbotom)

The Arbotom (example shown above) is an impulse-detecting tomographic instrument: it simultaneously records the time (in meters per second) that impulses or sound waves take to travel through wood between sensors placed around a tree's selected cross-section. Sound waves travel more slowly through defective wood than through sound wood. After each sensor is tapped to send sound waves to the other sensors, the differential measurements of the time each sound wave travels between sensors can be analyzed by the software.

APPENDIX B – ADVANCED TRUNK ANALYSIS

Sonic Wave Tomography (Line Velocity Map)

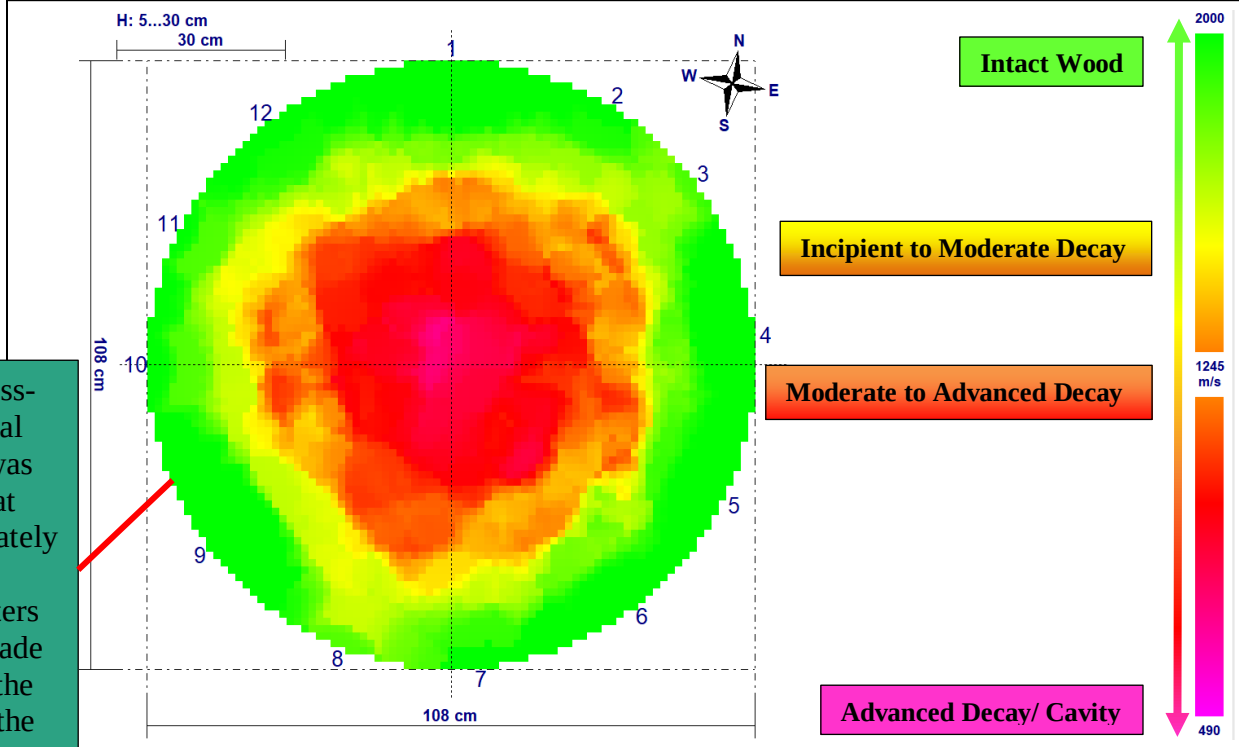


- Shown above is a line velocity map showing the average meters per second it took for sound waves to travel between the 12 sensors around tree. The key on the right shows the correlation between line colors and the average time it took for the sound waves to travel between sensors. The two extremes on the color gradient are green and purple. Green is indicative of rapid sound travel (intact wood), and sound time travel increases as you travel down the color gradients until you reach purple which is indicative of advanced decay or a cavity.

- The key on the right shows the correlation between line colors and the average time it took for the sound waves to travel between sensors. The two extremes on the color gradient are green and purple. Green is indicative of rapid sound travel (intact wood), and sound time travel increases as you travel down the color gradients until you reach purple which is indicative of significant decay or a cavity.

APPENDIX B – ADVANCED TRUNK ANALYSIS

Sonic Wave Tomography (2D Graph)

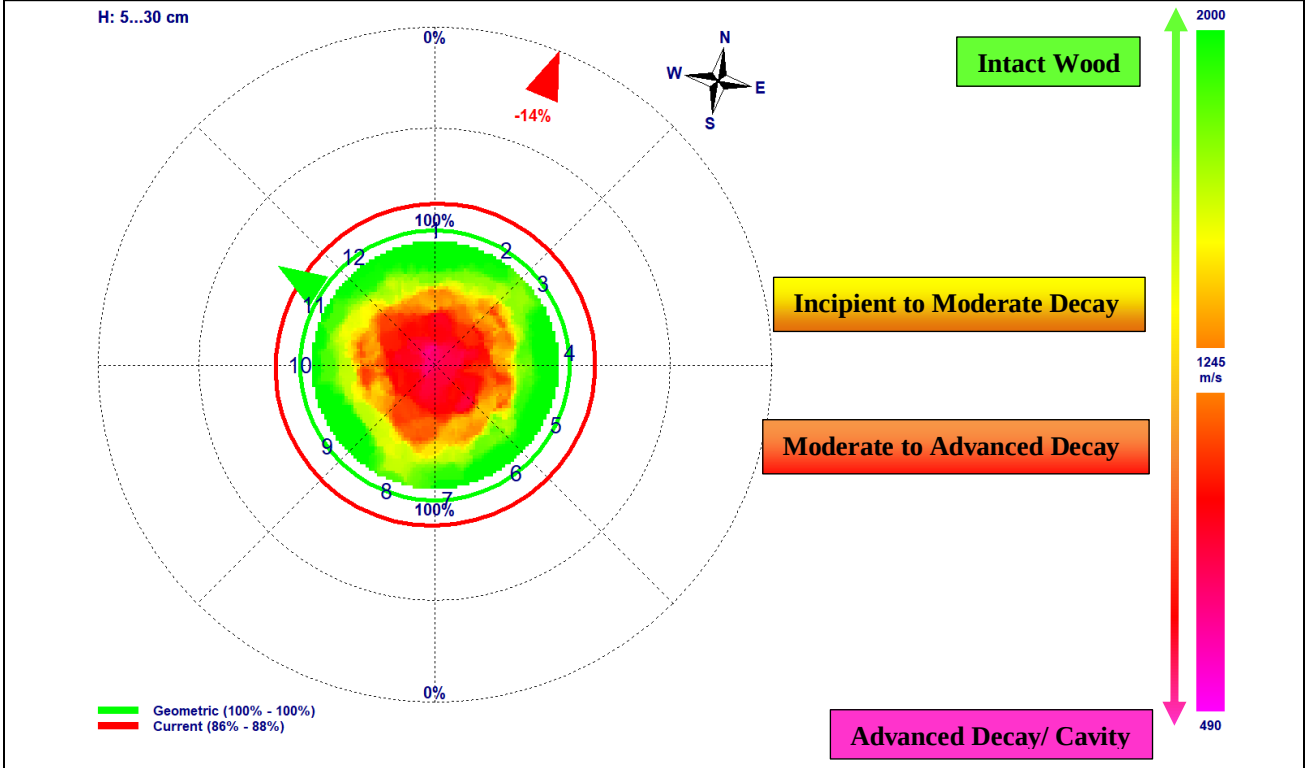


This cross-sectional image was taken at approximately 5-30 centimeters above grade around the base of the trunk.

- Shown above is another 2D cross-sectional graph that was calculated from the line graph (by Arbotom software). This graph puts together a more visually relatable interpretation of what the density/ elasticity of wood inside of this cross-section looks like. As you can see, there appears to be significant amount decay (mostly moderate to advanced) that gets progressively worse towards the center of the trunk.

APPENDIX B – ADVANCED TRUNK ANALYSIS

Sonic Wave Tomography (Mechanical Graph)



- The image above shows a mechanical graph module that estimates the weakest point (at the tested cross-section) of the tree in response to loads such as wind. The graph above indicates that the tested cross-section is approximately 14% weaker to a wind load coming from the south- west than if the wood were intact. This is based on a perfect circle and does not consider the tree's responsive growth. Although this strength loss is relatively minor, the internal decay and evidence of sulfur conks (*Laetiporus spp.*) can be an indicator of more advanced root decay. Signs of stress in the canopy and epicormic growths is also an indicator of root problems as it's unable to uptake necessary water and nutrients.

APPENDIX C - RISK MATRICES

The red arrows are used to guide you through the process of determining the overall risk associated with the subject tree.

Matrix 1 (Basal/ Root Failure)

This matrix is used to estimate the likelihood of the specified tree failure and impact to the 1717 N Vulcan Ave building. The pink box exemplifies a somewhat likely failure and impact scenario in the next year if no mitigation is implemented.

Likelihood of Failure	Likelihood of Impacting Target			
	Very Low	Low	Medium	High
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2 (Basal/ Root Failure)

This matrix is used to determine the overall level of risk associated with the subject tree by using the likelihood of failure and impact in combination with severity of the consequences. The pink box exemplifies an overall moderate risk for the tree under discussion at its current state.

Likelihood of Failure and Impact	Consequences			
	Negligible	Minor	Significant	Severe
Very likley	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

ASSUMPTIONS AND LIMITING CONDITIONS

1. Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the Consultant can neither guarantee nor be responsible for the accuracy of information provided by others. Standard of Care has been met with regards to this project within reasonable and normal conditions.

2. The Consultant will not be required to give testimony or to attend court by reason of this report unless subsequent contractual agreements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.

3. Loss or alteration of any part of this report invalidates the entire report.

4. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior written consent of the Consultant.

5. This report and any values expressed herein represent the opinion of the Consultant, and the Consultant's fee is in no way contingent upon the reporting of a stipulated result, a specified value, the occurrence of a subsequent event, nor upon any finding to be reported.

6. Unless expressed otherwise: 1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and 2) the inspection is limited to visual examination of accessible items without dissection, excavation, or coring, unless otherwise stated. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the tree(s) or property in question may not arise in the future.

7. Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. It is highly recommended that you follow the arborist recommendations; however, you may choose to accept or disregard the recommendations and/or seek additional advice.

8. Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specific period of time.

9. Any recommendation and/or performed treatments (including, but not limited to, pruning or removal) of trees may involve considerations beyond the scope of the arborist's services, such as property boundaries, property ownership, site lines, disputes between neighbors, and any other related issues. Arborists cannot take such considerations into account unless complete and accurate information is disclosed to the arborist. An arborist can then be expected to consider and reasonably rely on the completeness and accuracy of the information provided.

10. The author has no personal interest or bias with respect to the subject matter of this report or the parties involved. He/she has inspected the subject tree(s) and to the best of their knowledge and belief, all statements and information presented in the report are true and correct.

11. Unless otherwise stated, trees were examined using the risk assessment criteria detailed by the International Society of Arboriculture's publications *Best Management Practices – Tree Risk Assessment* and the *Tree Risk Assessment Manual*.

BIBLIOGRAPHY

Harris, Richard W., James R. Clark, and Nelda P. Matheny. *Arboriculture: Integrated Management of Landscape Tree, Shrubs, and Vines.* New Jersey: Prentice Hall, 2004. Print (ISA) *International Society of Arboriculture*. Web. 15 March 2014.

Smiley, Thomas E., Nelda Matheny, and Sharon Lilly. *Best Management Practices: Tree Risk Assessment.* Illinois: International Society of Arboriculture, 2011. Print.

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GLOSSARY

Best Management Practices (BMPs) – The International Society of Arboriculture has developed a series of Best Management Practices (BMPs) for the purpose of interpreting tree care standards and providing guidelines of practice for arborists, tree workers, and the people who employ their services.

Bending Moment - The algebraic sum of all the moments to one side of a cross-section ofa beam or other structural support.

Buttress Root- Large structural roots most common to trees native to rainforest soils where nutrients are not as abundant or accessible in the deeper soil layers.

Canopy – The part of the crown composed of leaves and small twigs (Harris, Clark, and Matheny 526).

Cavity – An open wound, characterized by the presence of decay and resulting in a hollow (Harris, Clark, and Matheny 527).

Codominant – Equal in size and relative importance, usually associated with either the trunks/stems or scaffold limbs/branches in the crown (Harris, Clark, and Matheny 527).

Compartmentalization – Natural defense process in trees by which chemical and physical boundaries are created that act to limit the spread of disease and decay organisms.

Crown – The leaves and branches of a tree measured from the lowest branch on the trunk to the top of the tree (Harris, Clark, and Matheny 527).

Decay – Process of degradation of woody tissues by fungi and bacteria through the decomposition of cellulose and lignin (Harris, Clark, and Matheny 527).

Failure – Breakage of stem, branch, roots, or loss of mechanical support in the root system (Smiley, Matheny, and Lilly 48).

Fungal Fruiting Bodies – Any complex fungal structure that contains or bears spores.

Included Bark – Pattern of development at branch junctions where bark is turned inward rather than pushed out (Harris, Clark, and Matheny 529).

Level 2 Basic Assessment: - A Level 2 or basic assessment is a detailed visual inspection of a tree and its surrounding site, and a synthesis of the information collected. It requires that a tree risk assessor walk completely around a tree looking at the site, buttress roots, trunk, and branches. A basic assessment may include the use of simple tools to gain additional information about the tree or defects. This is the standard assessment that is performed by arborists in response to a client's request for tree risk assessment (Smiley, Matheny, and Lilly 15).

Level 3 Advanced Assessment: – Advanced assessments (generally more time intensive) that are performed in conjunction with or after a Level 2 assessment to provide detailed information about specific tree parts, defects, targets, or site conditions. Specialized equipment, data collection and analysis, and/or expertise are usually required for advanced assessments. Procedures and methodologies should be selected and applied as appropriate, with consideration for what is reasonable to specific conditions and situations. All technologies involve some uncertainty and have their limitations; any evaluation of an individual tree will not be an accurate measure, but a qualified estimation. Information collected from advanced assessments can aid in making a final tree removal or retention recommendation.

Live Crown Ratio – The ratio of the height of the live crown to the height of the entire tree.

Minor Consequence – A consequences that involves low to moderate property damage, small disruptions to traffic or communication utility, or a very minor injury, examples include:

- A small branch striking a house roof from a high height.
- A medium sized branch striking a deck from a moderate height.
- A large part striking a structure and causing moderate monetary damage.
- Short term disruption of power at a service drop to a house.
- Temporary disruption of traffic on a neighborhood street.

Negligible Consequence – A consequence that involves low-value property damage or disruption that can be replaced or repaired; they do not involve personal injury, examples include:

- A small branch striking a fence.
- A medium-sized branch striking a shrub bed.
- A large branch striking a structure and causing low monetary damage.
- Disruption of power to landscape lighting.

Resistograph – A specialized instrument that uses a micro drill bit to measure wood resistance as it enters the tree. This data is translated into a graph to evaluate internal wood decay.

Reduction Pruning – Pruning cut that reduces the length of a branch back to live lateral branch large enough to assume apical dominance. Typically at least one-third the diameter of the cut parent branch.

Response Growth - New wood produced in response to loads to compensate for higher strain in marginal fibers; includes reaction wood (compression and tension) and woundwood (Smiley, Matheny, and Lilly 50).

Removal Pruning Cut: A pruning cut that takes off a branch back to the trunk or parent stem to just beyond the branch collar.

Risk – The combination of the likelihood of an event and the severity of the potential consequences. In the context of trees, risk is the likelihood of a conflict or tree failure occurring and affecting a target, and the severity of the associated consequence—personal injury, property damage, or disruption of activities (Smiley, Matheny, and Lilly 50).

Severe Consequence – A consequence that could involve serious personal injury or death, disruption of important activities, damage to high-value property, examples include:

- Injury that may result in hospitalization or permanent damage.
- A medium- sized part striking an occupied vehicle.
- A large part striking an occupied house.
- Serious disruption of high-voltage distribution and transmission powerline.
- Disruption of arterial traffic or motorways.

Significant Consequence – A consequence that involves property damage of moderate – high value, considerable disruption, or personal injury, examples include:

- A medium sized part striking an unoccupied vehicle from a moderate to high height.
- A large part striking a structure and resulting in high monetary damage.
- Disruption of distribution primary or secondary voltage power lines, including individual services and street- lighting circuits.
- Disruption to traffic on a secondary street.

Sonic Wave Tree Decay Detector –The Sonic Wave Tree Decay Detector is an instrument that is used for detecting decay in trees. The tool measures the time (in microseconds per foot) it takes for sound waves to travel from between the two probes as well as giving you a basic graph of the sound wave.

Stem – The main trunk of a tree or other plant (Harris, Clark, and Matheny 533).

Structural Pruning – Pruning that influences the orientation, spacing, growth rate, strength of attachment or ultimate size of branches and stems, resulting in a strong tree.

Target – People, property, or activities that could be injured, damaged, or disrupted by a tree (Smiley, Matheny, and Lilly 50).

Target zone – The area where a tree or branch is likely to land if it were to fail (Smiley, Matheny, and Lilly 50).

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